

Assessment the Efficacy of Subgaleal Drain after Burr-Hole Evacuation of Chronic Subdural Hematoma

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Abstract

Background: One of the most prevalent conditions affecting neurosurgeons is chronic subdural hematoma (CSDH), which is defined as an abnormal accumulation of liquified blood underneath the dura mater's innermost layer.

Aim: To assess the subgaleal drain's (SGD) effectiveness and safety following the burr hole evacuation of a CSDH.

Methods: This retrospective and prospective study was carried out on 60 patients with CSDH underwent burr hole evacuation at Al-Azhar University Hospital. All patients were assessed clinically by using modified Rankin scale (mRS).

Results: There was statistically significant difference between studied variables regarding Bilateral CSDH. When it came to recurrence and total resolution, the variables that were evaluated differed significantly.

Conclusions: The SGD system is technically easy to implement, has a low recurrence risk, and is relatively safe. This technique eliminates the possibility of acute cerebral bleeding by positioning the drainage tube so that it does not come into direct contact with the brain tissue and membranes of CSDH. Thus, the SGD system is useful for patients with a higher risk of complications.

Keywords: Efficacy; Subgaleal Drain; Burr-Hole Evacuation; Chronic Subdural Hematoma

1. Introduction

An abnormal deposition of liquified blood below the inner layer of the dura mater is known as a chronic subdural hematoma (CSDH), and it is one of the most prevalent neurosurgical disorders. Significant morbidity and mortality are connected with its frequent occurrence in the elderly.¹

Among the several neurosurgical procedures performed, CSDH evacuation ranks high. As the population's average age rises, the likelihood of CSDH being the most prevalent cranial neurosurgical disorder is high, and this trend is projected to continue until 2030.²

Although surgical evacuation is the gold standard for CSDH treatment, alternate methods such as burr-hole procedures with passive subdural drainage, continuous

irrigation, subgaleal (or subperiosteal) drainage, and twist-drill craniotomy are equally frequent. Appropriately powered comparative studies assessing the various draining strategies following burr-hole evacuation are nonexistent, and there is no evidence to suggest that any one technique is better than the others.³

An ongoing area of research is the CSDH recurrence rate, which may reach up to 30% after surgery. Drainage following burr hole evacuation has been demonstrated to decrease CSDH recurrence and death rates by 2 to 3 times, making it an attractive option for those seeking the optimal method to lower the recurrence rate. But the insertion of subdural drainage (SDD) is fraught with risk, since it has the potential to injure brain tissue, trigger epileptic episodes, and enable infection.⁴

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The goal of subperiosteal drainage (SPD), sometimes called extra-calvarial drainage (ECD) or subgaleal drainage (SGD), is to reduce the likelihood of damage to the brain parenchyma by placing a drain between the periosteum and the calvarium. Compared to SDD, SPD has a smaller technical demand as well. Most surgeons favor SDD over SPD, and the evidence for the procedure is still debatable.⁵

An investigation into the effectiveness and safety of subdural drains revealed a tendency for an increased incidence of complications in a meta-analysis. Another group found a 6.1% probability of brain tissue injury. Placing the drain in the subgaleal space rather than the subdural space is an alternate technique to decrease damage related to the insertion of the drain. Subgaleal drains are just as effective as subdural drains, according to recent research. They are believed to be just as effective and have a lower risk profile.⁶

An ongoing area of research is the CSDH recurrence rate, which can range from 0% to 30% after surgery. Finding the most effective method to decrease the recurrence rate is desirable; one such method is drainage following burr hole evacuation, which has been demonstrated to decrease CSDH recurrence and death rates by a factor of two to three times. One major issue with SDD insertion is the potential for brain parenchyma damage, epileptic episodes, and infection.^{7,8}

The aim of this study was to assess the subgaleal drain's (SGD) effectiveness and safety following the burr hole evacuation of a CSDH.

2. Patients and methods

Sixty patients diagnosed with CSDH who had burr hole evacuations performed at Al-Azhar University Hospital between December 1, 2023, and December 1, 2024 were the subjects of this prospective and retrospective study. We made sure to get patients' written informed permission. Prior to its execution, the research received the light from Al-Azhar University's Faculty of Medicine's Ethics Committee.

Inclusion criteria:

Patients aged ≥ 18 years were included in the study.

Exclusion criteria:

This study excluded pregnant women, those with meningeal carcinomatosis or spontaneous intracranial hypotension, patients with recurrent CSD hematomas, encephalopathy, or other medical conditions that made surgery impossible, and patients with clinical infections or encephalopathy.

All patients were subjected to: complete history taking, Physical examinations, Routine laboratory investigations, and Radiological

investigations.

Surgical procedure:

Type of anaesthesia: General anesthesia with endotracheal tube, local with sedation, and local only.

All patients underwent one or two burr-hole evacuations, and a subgaleal drain was inserted.

Clinical evaluation:

All patients were assessed clinically using mRS. Patient death is indicated by a score of 6, severe disability is indicated by scores of 4-5, and mild to moderate disability is indicated by scores of 0-3.

Outcome measurements and follow-up:

Assessment of the efficacy and safety of subgaleal drain after burr hole evacuation of CSDH. All Patients were allocated to the combined clinical and radiological follow-up on the first 2 days, day 30, and clinical follow-up at 6 months. Patients were received an immediate CT scan in case of any new or persisting neurological deficit.

3. Results

Table 1. Distribution of demographic data, comorbidities, clinical features in the studied variable

STUDIED VARIABLE N= 60		
AGE (YEAR)	Mean $\pm$ SD	63.3 $\pm$ 14.4
	25- 50	10 (16.7%)
	50-70	30 (50%)
	70-89	20 (33.3%)
SEX	Male	51(85%)
	Female	9 (15%)
SITE OF HEMATOMA	Bilateral CSDH	8 (13.3%)
	RT CSDH	32 (53.3%)
	LT CSDH	20 (33.3%)
SIZE OF HEMATOMA	effacement cortex	11(18.3%)
	compression of the ipsilateral ventricle	23 (38.3%)
	midline shift	26 (43.3%)
COMORBIDITIES	Hypertension	21 (35%)
	Diabetes mellitus	20 (33.3%)
	CKD	2 (3.3%)
	IHD	7 (11.6%)
	Others	6 (10%)
PRESENTATION	Headache	50 (83.3%)
	DCL	10 (16.67%)
	Focal neurologic deficit	34 (56.7%)
	Vomiting	2 (3.3%)
GLASGOW COMA SCALE	(9-12)	4 (6.7%)
	(13-15)	56 (93.3%)

Data are presented as mean $\pm$ SD or frequency (%). DCL: Disturbed Consciousness Level, IHD: Ischemic heart disease, CKD: Chronic kidney disease, GCS: Glasgow Coma Scale, CSDH: Chronic subdural haematoma

Table 1 shows that, mean age of studied variable was 63.3 ± 14.4 years, the Age of studied variable ranged from 25 to 89 years, 16.7% of patients their age 25-50 years, 50% of patients their age between 50-70 years and 33.3% of patients their age 70-89 years. 85% of patients were males and 15 % were females, the site of hematoma there was bilateral CSDH by 13.3%, RT CSDH by 53.3% and LT CSDH by 33.3%, in size of hematoma there was effacement of cortex by 18.3%, compression of the ipsilateral ventricle by 38.3% and midline shift by 43.3% ,35% of patients had Hypertension, 33.3% had Diabetes mellitus, 3.3% had CKD, 11.6% had IHD and 10% of patients had other comorbidities. on presentation there was 83.3%

had headache, 16.67% had DCL, 56.7% had focal neurologic deficit, 3.3% had vomiting, Glasgow coma scale 6.7% had score from (9-12) and 93.3% had score from (13-15).

Table 2. Distribution of mRS in the studied variable

MODIFIED RANKEL SCALE (MRS)	STUDIED VARIABLE N= 60	
0	37 (61.67%)	
1	10 (16.67%)	
2	5 (8.33%)	
3	3 (5%)	
4	2 (3.33%)	
5	0 (0%)	

Data are presented as mean $\pm$ SD or frequency (%).

Table 2 : shows that, 64.67% had mRS grade 0, 16.67% had mRS grade 1, 8.33% had mRS grade 2, 5% had mRS grade 3, 3.33% had mRS grade 4 and 5% had mRS grade 6 (the cause of death in one case was sudden cardiopulmonary arrest, while the two cases died from complication of chest infection)

Table 3. Relation between mRS, complete resolution and recurrence.

MRS	0 N= 37	1 N= 10	2 N= 5	3 N= 3	4 N=2	5 N=0	6 N=3	P
Complete resolution	37 (61.7%)	9 (15%)	4 (6.6%)	1 (1.7%)	0 (0%)	-	0 (0%)	<0.001*
Recurrence	0 (0%)	1 (1.7%)	1 (1.7%)	2 (3.3%)	2 (3.3%)	-	0 (0%)	<0.001*

Data are presented as frequency (%), DM: diabetes mellitus, HTN: hypertension, IHD: Ischemic heart disease, CKD: Chronic kidney disease, GCS: Glasgow Coma Scale, CSDH: Chronic subdural haematoma * Significant as P-value $\leq$ 0.05.

Table 3 There was statistically significant difference between clinical and radiological evaluation regarding complete resolution and Recurrence.

Table 3. Relation between late radiological evaluation and demographic data

		RESOLUTION N= 51	NON-RESOLUTION N= 6	P-VALUE
AGE	25-50	10 (16.7%)	0 (0%)	0.23
	50-70	26 (43.3%)	3 (5%)	0.96
	70-89	15 (25%)	3 (5%)	0.3
SEX	Male	45 (75%)	4 (6.6%)	0.15
	Female	6 (10%)	2 (3.3%)	
	DM	18 (30%)	1(1.7%)	0.35
	HTN	15 (25%)	4 (6.6%)	0.06
	IHD	4 (6.6%)	2 (3.3%)	0.054
	CKD	1(1.7%)	1 (1.7%)	0.06
	OTHERS	6 (10%)	0 (0%)	0.37
GCS	(9-12)	1 (1.7%)	1(1.7%)	0.06
	(13-15)	50 (83.3%)	5 (8.3%)	
HEADACHE		47 (78.3%)	3(5%)	0.002*
FOCAL NEUROLOGIC DEFICIT		29 (48.3%)	5 (8.3%)	0.21
SITE OF HEMATOMA	Bilateral CSDH	4 (6.6%)	3(5%)	0.002*
	RT CSDH	28 (46.7%)	2 (3.3%)	0.31
	LT CSDH	19 (31.7%)	1 (1.7%)	0.31
SIZE OF HEMATOMA	Effacement cortex	10 (16.6%)	1 (1.7%)	0.86
	Compression of the ipsilateral ventricle	20 (33.3%)	2 (3.3%)	0.78
	Midline shift	21(35%)	3 (5%)	0.67

Data are presented as frequency (%), DM: diabetes mellitus, HTN: hypertension, IHD: Ischemic heart disease, CKD: Chronic kidney disease, GCS: Glasgow Coma Scale, CSDH: Chronic subdural haematoma * Significant as P-value $\leq$ 0.05.

Table 4 Shows that, there was no statistically significant difference between studied variables regarding other variables, while there was statistically significant difference between studied variables regarding bilateral CSDH.

Case Presentation:

Case 1:

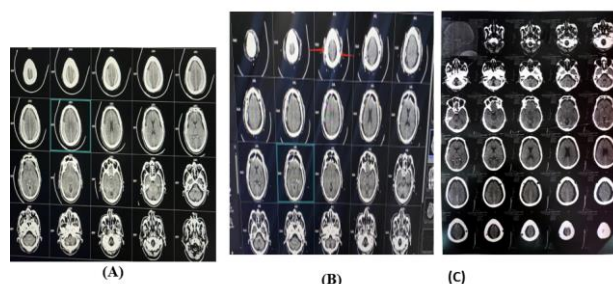


Figure 1. (A): 80 years old male patient presented with headache and altered mental status, Preoperative axial CT brain shows bilateral frontoparietal subdural hemorrhage of different ages, (B): post operative axial CT brain in first 2 days show reduced collection bilaterally more on left side with mild pneumocephalus that was treated conservatively, red arrow point of subgaleal drain over the burrholes, (C): follow up axial CT brain after 1 month shows residual extra-axial collection bilaterally isodense to the CSF with no mass effect, the patient clinically improved a part of mild headache medically treated.

Case 2:

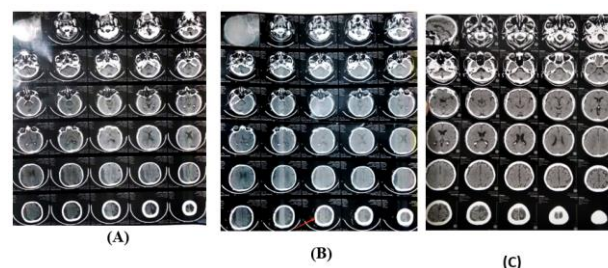


Figure 2. (A): 69 years old male patient presented with headache and left side weakness, preoperative axial CT brain shows right frontoparietal subdural hematoma, with mass effect in the form of effacement of the cerebral cortex, compression of the lateral ventricle and mild midline shift, (B): post operative axial CT brain in first 2 days shows reduced subdural collection, red arrows point of subgaleal drain overlying burrhole, (C): follow up axial CT brain after 1 month shows complete resolution of hematoma.

4. Discussion

The study found that the age of the analyzed variables ranged from 25 to 89 years, with a mean age of 63.3 ± 14.4 years. 10 (16.7%) of patients were aged 25-50 years, 30 (50%) of patients were aged between 50-70 years, and 20 (33.3%) of patients were aged 70-89 years. 51 (85%) of patients were males and 9 (15%) were females.

females, the site of hematoma was bilateral CSDH by 13.3%, RT CSDH by 53.3% and LT CSDH by 33.3%, in terms of the size of hematoma, there was effacement of cortex by 18.3%, compression of the ipsilateral ventricle by 38.3% and midline shift by 43.3%.

These results are in agreement with Akhtar et al.,⁹ who reported 44 patients who underwent SGD inserted following the two burr-hole evacuation of CSDH. With an average age of 70.1 ± 8 years, there were 31% females and 69% males.

Concerning our results, 21(35%) of patients had HTN, 20 (33.3%) had DM, 2 (3.3%) had CKD, 7(11.6%) had IHD, and 6(10%) of patients had other comorbidities.

In alignment with our study, Gomaa et al.,¹⁰ revealed that in 53 patients with CSDH who underwent evacuation and SGD insertion, 20 of them were hypertensive, 13 of them were diabetic, 8 of them had cardiac problems, 2 of them were hepatic patients, and 5 of them had renal failure.

Also, Akhtar et al.,⁹ supported our results as they found that in 64 patients with CSDH who underwent evacuation and SGD insertion, 23 patients (or 35% of the total) had a history of hypertension, while 17 patients (or 26%) had diabetes.

The study shows that, on presentation there was 50 (83.3%) had headache, 10 (16.67%) had DCL, 34 (56.7%) had focal neurologic deficit, 2 (3.3%) had vomiting, GCS 4 (6.7%) had score from (9-12) and 56 (93.3%) had score from (13-15).

Oral et al.,¹¹ support our findings by demonstrating that among 64 patients who underwent CSDH evacuation and SGD insertion, headache is the most frequent symptom (51.3% of patients). In addition, 51.3% of patients experienced a weakening of the limbs, 20.5% experienced a decrease in consciousness, 5.1% had seizures, 1.2% had diplopia, 11.5% had vertigo, and 10.2% had cognitive dysfunction.

Furthermore, Akhtar et al.,⁹ found that 44 patients (68%) reported confusion and 45 patients (70%) reported headaches as the most frequent symptom. The GCS ranged from 3 to 8 in 9 patients, or 14% of the total, had this result.

Regarding our results, 22(36.6%) of patients were on antiplatelets, and 17 (28.3%) were on Warfarin.

In the same line, Gomaa et al.,¹⁰ showed the same as they demonstrated that 53 patients with CSDH underwent evacuation with SGD insertion, 19 (35.85%) of cases were on anticoagulation.

Added to that, Akhtar et al.,⁹ agreed to ours as they found 44 patients with CSDH underwent evacuation with SGD insertion. When they

presented, 18 patients (28%) were on anticoagulants such Warfarin, while 23 patients (36%) were on antiplatelet medicines.

On clinical assessments, the study shows that 37(61.67%) had mRS grade 0, 10(16.67%) had mRS grade 1, 5(8.33%) had mRS grade 2, 3(5%) had mRS grade 2,2 (3.33%) had mRS grade 4 and 3(5%) had mRS grade 6 (the cause of death in one case was sudden cardiopulmonary arrest, while the two cases died from complication of chest infections).

Similarly, Akhtar et al.¹² concurred with our findings since they discovered that 64 patients with surgically significant CSDH received two burr-hole craniectomies, evacuation, and SGD insertion. On the GOS, 53 individuals, or 83%, achieved positive results (4-5).

Our results show that, there was 54(90%) resolved from hematoma, recurrence rate was 6(10%), and 18(30%) had pneumocephalus.

These results are consistent with Akhtar et al.,⁹ who declared in 64 patients had CSDH underwent evacuation and SGD, 61 (95.3%) resolved from hematoma, recurrence rate was 11%, and 29.7 % had pneumocephalus.

Furtherly, Greuter et al.¹³ showed in 116 below than 80 years and 104 patients equal or more than 80 years had CSDH underwent evacuation with SGD, recurrence rate was 9.5% in patient below 80 years and 10.6% in patients above 80 years.

On clinical outcomes, the study shows that there was no statistically significant difference between studied variables regarding other variables, while there was a statistically significant difference between studied variables regarding GCS.

Ishida et al.,¹⁴ confirmed our findings by showing that MRS was significantly different regarding GCS; in fact, they discovered that twenty-seven patients (or 27% of the total) experienced a worsening of mRS upon discharge, with the majority experiencing a decline in cognitive function or mobility, necessitating a transfer to a rehabilitation facility. A poor functional outcome was linked with preoperative consciousness disturbance induced by CSDH, a history of dementia, postoperative delirium, and pre-hospital mRS before onset of CSDH, according to a univariate analysis.

Nouri et al.,¹⁵ demonstrated that patients with lower mRS scores had a better prognosis compared with those with greater preoperative mRS, and this finding influenced the same outcomes.

There was a statistically significant difference between the researched variables regarding Bilateral CSDH, but no statistically significant difference between the studied variables regarding other variables according to late radiological

results.

Agwa et al.,¹⁶ 53 patients (14.4%) were found to have bilateral CSDH, which led them to the same conclusion. There was a statistically significant correlation between bilateral hematoma and a poor prognosis ($p = 0.041$).

Because of the increased risk of pneumocephalus and the fact that both sides of the procedure must be done at the same time, the resolution of bilateral CSDH is much lower than that of unilateral procedures, and the brain re-expansion is similarly poorer. Brain re-expansion and full hematoma evacuation and irrigation are both obstructed by septations or membranes.¹⁶

Clinical and radiological results differed significantly between complete resolution and recurrence, according to the study.

Further, Omerhodžić et al.,¹⁷ showed that burr hole surgery, whether done as a single or two procedures, is a good alternative for treating CSDH. Patients who underwent the procedure had better results in clinical and radiological evaluations after the procedure compared to patients who had recurrence.

4. Conclusion

The SGD system is technically easy to implement, has a low recurrence rate, and is relatively safe. This technique eliminates the possibility of acute cerebral bleeding by positioning the drainage tube so that it does not come into direct contact with the brain tissue and membranes of CSDH. Thus, the SGD system is useful for patients with a higher risk of complications.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

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All authors have a substantial contribution to the article

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There are no conflicts of interest.

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